PROJECT FACT SHEET

CONTRACT TITLE: Characterization of a Fractured Dolomite Reservoir in Preparation for Water Flooding. (PARTNERSHIP) Murphy Oil

DATE REVIEWED: 01/28/93 **DATE REVISED:** 12/22/92

OBJECTIVE: To evaluate the application of seismic mapping technologies developed by LANL for acquisition of information important for optimizing the design of waterfloods in fractured oil reservoirs.

ID NUMBER: FEW PG12

B & R CODE: AC1510100

CONTRACTOR: Los Alamos National Lab

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CONTRACT PERFORMANCE PERIOD:
04/01/89 to 12/30/92
PROGRAM: Lt Oil
RESEARCH AREA:

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PROJECT SITE:
Los Alamos, NM

SCHEDULED MILESTONES:

Well selection and field investigation	07/90
Field emplacement of three downhole geophones	11/90
Microseismic data collection in Tomahawk Field, starting	11/90
and will continue on to this period of time.	09/91
Microseismic data processing starting.	03/91
Final Report due.	03/93

FUNDING (1000'S)	DOE	OTHER	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	531	0	0	**531**
FISCAL YR 1993	0	0	0	**0**
FUTURE FUNDS	0	0	0	**0**
TOTAL EST'D FUNDS	**531**	**0**	**0**	**531**

PROJECT DESCRIPTION: The objective of this research is to determine the extent to which the microseismicity of aging oil fields that is associated with withdrawal and injection of reservoir fluids can be used to locate fractures controlling production and hence to provide engineering data with which to design enhanced recovery from these fields.

PRESENT STATUS: Project completed with a final report being reviewed and completed.

ACCOMPLISHMENTS: Microseismicity was monitored in the Chaveroo field using a single 3-component downhole geophone in June-July, 1989 while a pilot waterflood operation was started. Intermittent monitoring during the waterflood suggested episodic occurrence of microearthquakes. Microseismic events were at times detected at rates up to several hundred per day and at distances exceeding one mile, but mostly within 3000 ft, of the monitor well. Hodogram locations of events show seismicity occurring mostly within the San Andres dolomite near the depth interval of production. The follow-up experiment was conducted in the Tomahawk oil field located 10 miles west of the Chaveroo site. Production in the Tomahawk is also from the San Andres dolomite and like the Chaveroo field, is also in a late stage of primary production. However, no waterflood operation took place in the Tomahawk field during monitoring. In July, 1990 a geophone package was sequentially deployed in 4 wells to measure ambient noise levels and monitor seismicity occurrence. A long term monitoring network of geophone packages was then deployed in 3 wells with full-time monitoring coverage capability. No seismicity within or near the geophone array was detected during normal production activity over a 3.5-month period of constant monitoring. However, during this time events occurring along the southern flank of the field, 2.5 miles from the array were detected at a rate of 1 to 2 per week. These events are most closely associated with a salt water disposal well injecting about 400 bbl per day into the permeable zones of the San Andres. In a third phase of the experiment, production was increased nearby the geophone array by putting 7 previously offline wells on flush production. This was followed by normal cycled, pumped production and pressure build-up measurements on 3 of the 7 wells. No seismicity was detected during the third phase of monitoring which lasted seven weeks. From the limited experience of these monitoring experiments, it appears that microseismicity occurs in these aged reservoirs only while fluid injection is taking place.

BACKGROUND: The Chaveroo San Andres Field is similar to other fields producing oil from the San Andres Dolomite in southeast New Mexico and Texas. After primary production, water flooding is employed to improve the long-term production from the field. Because existing well locations bear no specific relationship to natural and stimulated fractures in the San Andres rock, injected water can prematurely communicate between wells through fractures and thus bypass porosity of the rock. This situation could be worked to advantage if the location of primary conductive fractures could be determined in advance. Injection wells could be located parallel to these fractures to sweep additional oil toward the fractures and then to production wells. Los Alamos was in collaboration with Murphy Operating Corporation in a series of field experiments to evaluate the application of seismic mapping technologies to obtain data for optimizing the design of water floods in fractured oil reservoirs.